Calcium Ca

General Information

Discovery

Calcium was first isolated by Sir Humphry Davy in 1808 in London, although lime, or calcium oxide, was prepared by the Romans in the first century.

Appearance

Calcium is a silvery-white, relatively soft metal.

Source

Calcium is the fifth most abundant metal in the Earth's crust, greater than 3% by mass. It is not found free in nature, but occurs abundantly as limestone (calcium carbonate), gypsum (calcium sulphate), fluorite (calcium fluoride) and apatite (calcium chloro- or fluoro-phosphate). Calcium is prepared commercially by the electrolysis of fused calcium chloride to which calcium fluoride is added to lower the melting point.

Uses

Calcium and its compounds are widely used. Quicklime (calcium oxide), which is made by heating limestone and can be changed into slaked lime by the addition of water, is a substance often used by the chemical industry. It has the advantage of being cheap and readily available. When mixed with sand it takes up carbon dioxide from the air and hardens as mortar and plaster. Calcium from limestone is an important constituent of Portland Cement. Calcium is also used as a reducing agent in preparing other metals such as thorium and uranium, and as an alloying agent for aluminium, beryllium, copper, lead and magnesium alloys.

Biological Role

Calcium is an essential constituent of cells, teeth and bones. The normal amount found in an adult is over one kilogram, located mostly in the teeth and bones.

General Information

Calcium forms a coating of oxide and nitride in air, it reacts with water and burns with a yellow-red flame, forming mostly the nitride. Calcium carbonate is soluble in water containing carbon dioxide, and this causes hardness in water. This calcium carbonate is also the constituent of stalactites and stalagmites in caves where water drips slowly and evaporates *in situ*.

Physical Information

Atomic Number	20
Relative Atomic Mass (^{12}C=12.000)	40.078
Melting Point/K	1112
Boiling Point/K	1757
Density/kg m^{-3}	1550 (293K)
Ground State Electron Configuration	$[Ar]4s^2$
Electron Affinity ($M-M^-$)/kJ mol^{-1}	+186

Key Isotopes

Nuclide	^{40}Ca	^{42}Ca	^{43}Ca	^{44}Ca	^{45}Ca	^{46}Ca
Atomic mass	39.963	41.959	42.959	43.955	44.956	45.954
Natural abundance	96.94%	0.647%	0.135%	2.086%	0%	0.004%
Half-life	stable	stable	stable	stable	165 days	stable

Nuclide	^{47}Ca	^{48}Ca
Atomic mass	46.954	47.952
Natural abundance	0%	0.187%
Half-life	4.53 days	stable

Ionisation Energies/kJ mol^{-1}

M - M^+	589.7
M^+ - M^{2+}	1145
M^{2+} - M^{3+}	4910
M^{3+} - M^{4+}	6474
M^{4+} - M^{5+}	8144
M^{5+} - M^{6+}	10496
M^{6+} - M^{7+}	12320
M^{7+} - M^{8+}	14207
M^{8+} - M^{9+}	18191
M^{9+} - M^{10+}	20385

Other Information

Enthalpy of Fusion/kJ mol^{-1}	9.33
Enthalpy of Vaporisation/kJ mol^{-1}	150.6

Oxidation States

Ca^{+2}